The Northwestern MILLER

MILLING PRODUCTION SECTION

The Role of the Cereal Chemist In Human Nutrition and Science

By DR. LAWRENCE ZELENY

EDITOR'S NOTE: Dr. Zeleny is chief of the standardization and testing branch of the grain division of the Agricultural Marketing Service, U.S. Department of Agriculture and immediate past president of the American Association of Cereal Chemists. This article is a portion of the address he gave to open the 42nd annual AACC meeting.

We, as cereal chemists, have certain important basic responsibilities which many of us frequently lose sight of in our preoccupation with more immediate problems. How often do we stop to consider the broad objectives of our profession, or even perhaps to wonder what these objectives are? Certainly our most fundamental aim is through research and the application of scientific knowledge to learn new truths and devise ways in which the people of the world may be better fed. Nearly all of us are working toward that end in one way or another, although we may approach our objective from many widely different angles. Whether we are running routine flour ash determinations or delving into the effect of ionizing radiation on the microflora in stored grain, our basic objective is the same; namely, to provide more and better food for mankind.

Dr. Lawrence Zeleny

Although we are the American Association of Cereal Chemists, we must not confine our thinking and our efforts to the problems of one country. We are truly an international organization. Over 12% of our more than 1,100 members are in countries other than the U.S. We are represented in 26 different countries and in all of the continents of the world (except Antarctica). It is therefore important that we look at our science from a truly international viewpoint. Many parts of the world are looking to us for help in solving their food problems. In rendering technical guidance and assistance we are contributing materially to the better international understanding and friendship which are so badly needed in this world of ours.

Cereal products constitute the principal source of food in the world. In some countries from 80 to 90% of the caloric intake consists of cereals. Although the consumption of cereals in the U.S. is considerably less than in many other countries, they still contribute more to our diet on a caloric basis than any other class of food. In addition, they supply a very substantial part of our protein, "B" vitamins and iron. The rapid and accelerating rate of increase in population throughout the world may still further increase the importance of cereals in the diet, since the available farmland can produce more food in the form of grain than in the form of meat or dairy products.

Flour Enrichment

The "enrichment" of flour, bread, and other cereal products in the U.S. with "B" vitamins and iron is frequently belittled on the grounds that with our varied diet there is no need for the additional vitamins and minerals. It is quite true that the benefits of enrichment are much more difficult to demonstrate in the U.S. than in other countries where diets without enrichment are uniformly very deficient. Nevertheless, most nutrition authorities are convinced that the benefits of enrichment in the U.S. have been very real. Pellagra, due primarily to niacin deficiency, was once quite common in certain areas of the South, but has nearly disappeared since the introduction of enriched bread, corn meal, and grits. Symptoms of B-vitamin deficiencies are disappearing from among the patients of charity clinics while, at the same time, no comparable de-

(Continued on page 12a)

THE 42nd ANNUAL AACC MEETING

The American Association of Cereal Chemists held its 42nd annual meeting at San Francisco May 19-23. Reports on the various papers presented and the speeches given at the meeting will be found on this and the following pages in this publication.

Medal Winner Describes Work

At its 42nd annual meeting the American Association of Cereal Chemists awarded the Thomas Burr Osborne Medal to Dr. J. Ansel Anderson, chief chemist of the Board of Grain Commissioners for Canada.

In his address, Dr. Anderson dealt with the work of his laboratory with special emphasis on basic research. The Grain Research Laboratory in Winnipeg, he said, is primarily a service organization, and its research is devoted to improvement of its services. These involve the determination of the quality of many types of grain, with major dependence on small scale laboratory tests designed to imitate commercial procedures: milling and baking tests, macaroni making and laboratory malting of barley.

The three main crops with which the laboratory works offer interesting contrasts. Semolina from durum wheats is dead and easily managed, so that laboratory macaroni processing is relatively simple and the best of the small scale testing methods. Barley is alive throughout most of the malting process, and the living material reacts vigorously to changes in conditions, and thus presents problems of control that are not readily solved. Bread dough is almost as lively as barley; it is "a dynamic, sensitive and changeable material that is relatively hard to manage." But the major difficulty with bread flour is that it is baked by so wide a range of methods throughout the world. This multiplicity of methods is difficult to reproduce on a laboratory scale. The laboratory's research program seeks to improve these empirical testing methods and to augment them by means of basic research on the nature of quality in cereal grains.

Dr. Anderson began his research on malting barley in 1935 at the National Research Council Laboratories in Ottawa and continued it after he moved in 1939 to the Grain Research Laboratory in Winnipeg. On the applied side, he has been associated with the development of four different sets of laboratory malting equipment. The last of these, which handles 15 lb. samples and is designed to collaborate with ¼ bbl. brewing trials, provides for flexible programming combined with fully automatic control of the malt environment throughout the steeping germination and kilning procedures.

Macaroni Studies

Similar contributions have been made by the Grain Research Laboratory in studies of the macaroni-making quality of durum wheats. Early equipment for 5 lb. samples, purchased in the U.S., was augmented by construction of a cabinet to provide reproducible drying. After working for some years with a micro disk procedure, the laboratory then developed a micro method for producing a single strand of macaroni

(Continued on page 14a)

Dr. J. Ansel Anderson

DO YOU REMEMBER?

THE CHICAGO FIRE . . .

On a Sunday night in October, 1871, Mrs. O'Leary's cow kicked over a lantern in the barn and started the greatest conflagration of the times—The Chicago Fire. Over 2,000 acres of land were destroyed, including 17,400 buildings worth over 200 million dollars.

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Pictures of AACC Meeting Personalties . . .

AT THE CHEMISTS' EXHIBITS—During the exhibit phases of the recent annual meeting of the American Association of Cereal Chemists, Oscar Skovholt of the Quality Bakers of America Cooperative, Inc., New York, discusses testing equipment improvements with C. W. Brabender of the C. W. Brabender Instrument Co., South Hackensack, N. J. (Center) Lawrence S. Hopper of General Mills, Inc., Ogden, Utah, chats between sessions with William E. Dawson, the Brolite Co., Inc., Chicago. (Right) Ronald W. Johnson of Chas. Pfizer & Co., San Francisco, discusses supplements with Harry Burnett, Sunshine Biscuits, Inc., Oakland, Cal. The meeting was held at San Francisco.

AT THE AACC—The technical policy committee of the American Association of Cereal Chemists met before the annual meeting got officially under way. Part of the group is shown at the left above: Ross H. Cory, General Mills, Inc., San Francisco, Cal.; Kenton L. Harris, U.S. Food and Drug Administration, Washington, D. C., and Dr. Max Milner, Kansas State College, Manhattan. (Center) Benjamin Grogg, Barrington, Ill., and Philip E. Devue, Cedar Rapids, Iowa, both with Quaker Oats Co., discuss physical testing equipment with Arthur Hartkopf of Brabender Corp., Rocheïle Park, N. J. (Right) Signing up early for the AACC meeting are Ralph B. Potts, Wichita (Kansas) Flour Mills; William V. Van Scoy, Valier & Spies, St. Louis, and Kazuo Higaschiuchi, J. R. Short Milling Co., Chicago. There was a large number of early arrivals for the meeting.

SCENES AT THE AACC—In conversation in the hotel corridors during the annual meeting of the American Association of Cereal Chemists are (left) Frank W. Warren, Merck & Co., Rahway, N.J., William H. Carter, Shawnee (Okla.) Milling Co., and John F. Mahoney, with Merck in Rahway. (Center) Robert L. Hoecker, Consolidated Flour Mills, Wichita, Kansas, and Dean V. Webber, Russell-Miller Milling Co., Dallas, discuss the new twin-swing farinograph and the shortening rheometer with Peter Goldberg of MIAG Northamerica, Minneapolis, representatives for the C. W. Brabender Instrument Co., South Hackensack, N. J. (Right) Shown during his address on the Pillsbury micro-milling process is Ralph Gracza, Pillsbury Mills, Inc.

AACC'S SOCIAL, BUSINESS SIDES—In the reception line during the recent American Association of Cereal Chemists convention are, left to right above, Dr. and Mrs. Lawrence Zeleny, U.S. Department of Agriculture, Washington; Mr. and Mrs. William B. Bradley, American Institute of Baking, Chicago; Mr. and Mrs. Clinton L. Brooke, Merck & Co., Rahway, N. J., and Mr. and Mrs. D. B. Pratt, Jr., Pillsbury Mills, Inc., Minneapolis. (Center) George Carlin, Swift & Co., Chicago, discusses with Dr. L. W. Kinsell, Highland Hospital, Oakland, the basic points of the latter's address. (Right) In lobby conversation are L. C. Segren, Pillsbury Mills, Inc., Astoria, Cal., James C. Thomson, Pillsbury, Minneapolis; Arthur C. Weigel, California Milling Corp.

Spot Fumingation Evaluation Study Cost and Result Analysis

Fumigant Dosages Employed

Fumigant No. 1. (Current labels recommend 6 fluid oz. applications)—A dosage of 16 fluid oz. was used or 2⅔ times more than advertised.

Fumigant No. 2. (Current labels recommend 6 fluid oz. applications)—A dosage of 16 fluid oz. was used or 2⅔ times more than advertised.

Fumigant No. 3. (Current labels recommend 3 fluid oz. applications)—A dosage of 3 fluid oz. was used as label recommends. Experience has proven, however, that a dosage of 4 fluid oz. is necessary to meet present day sanitation standards.

Fumigant Cost Comparison

Fumigant No. 1 ("A" Mill, 4,000 cwt.)—40 gal. at $3.03 per gal., $121.20; 65 lb. methyl bromide (1 lb. cans) @ 81¢, $52.65; total $173.85. (Fumigant cost per cwt. for 4-wk. period, 0.43¢.)

Fumigant No. 2 ("B" Mill, 4,000 cwt.)—40 gal. @ $3.05 per gal., $122; 65 lb. methyl bromide (1 lb. cans) @ 81¢, $52.65; total, $174.65. (Fumigant cost per cwt. for 4-wk. period, .043¢.)

Fumigant No. 3 ("C" Mill, 8,500 cwt.)—16¾ gal. @ $8.60 per gal., $144.05; no methyl bromide used; total, $144.05. (Fumigant cost per cwt. for 4-wk. period, .016¢.)

Savings—Fumigant No. 3 resulted in a 62% saving over Fumigants Nos. 1 and 2.

Using the currently recommended dosage of 4 fluid oz. dosage of fumigant No. 3.

Twenty gal. Fumigant No. 3 @ $8.60 per gal., $172. (Fumigant cost per cwt. for 4-wk. period, .022¢.)

Saving—Fumigant No. 3 would then result in a 49% saving over Fumigants Nos. 1 and 2.

Labor Cost Comparison

Man hours required to pour: Fumigant No. 1 ("A" Mill, 4,000 cwt.); Fumigant No. 2 ("B" Mill, 4,000 cwt.)—Each required 16 man hours.

Sixteen man hours at time and one half at approximately $3 hour, $48. (Labor cost per cwt. to pour Fumigants Nos. 1 and 2, .012¢.)

Man hours to apply fumigant with semi-automatic applicator:

Fumigant No. 3 ("C" Mill, 8,500 cwt.)—Six man hours at time and one half at approximately $3 hour, $18. (Labor cost per cwt. to apply Fumigant No. 3, .002¢.)

Saving—Applying Fumigant No. 3 through semi-automatic applicator resulted in 5½ times less labor cost than to pour Fumigants Nos. 1 and 2.

FUMIGANT AND LABOR COST COMPARISON

Fumigant No. 1—Fumigant cost, $173.85; labor cost, $48; total $221.85. (Or total cost per cwt. each 4-wk. period, .055¢.)

Fumigant No. 2—Fumigant cost, $174.65; labor cost, $48; total, $222.65. (Or total cost per cwt. each 4-wk. period, .055¢.)

Fumigant No. 3—Fumigant cost, $144.05; labor cost, $18; total, $162.05. (Or total cost per cwt. each 4-wk. period, .019¢.)

Employing the proven dosage of 4 fluid oz. of Fumigant No. 3 per application point which has definitely eliminated the need for general fumigations in over 30 flour mills, the cost would have been:

Fumigant cost, $172; labor cost, $18; total, $190. (Or a total cost per cwt. each 4-wk. period of .022¢.)

Saving—Fumigant No. 3 would therefore have resulted in a 60% over-all saving.

GENERAL OBSERVATIONS

1. After the first four (4) months of the study in those mills using Fumigants Nos. 1 and 2, it was found necessary to have a general methyl bromide fumigation, as the infestation was getting out of control.

2. During the first four (4) months of the study, Fumigant No. 3 using the low 3 fluid oz. dosage resulted in superior insect control.

3. Fumigant No. 3 in the "C" mill was not applied in July, when the infestation started to increase.

4. Fumigant No. 3 was applied at the low 3 fluid oz. dosage the first seven (7) months before the 4 fluid oz. dosage was used. In December, the ninth month when the increased

EDITOR'S NOTE: Considerable interest was aroused among readers by the publication of the paper prepared by G. D. White, H. H. Walkden and H. D. Nelson of the Stored Product Insects Laboratory, Manhattan, Kansas, and presented by Dr. Leland Henderson of the U.S. Department of Agriculture to members of the Association of Operative Millers at Buffalo. E. H. Leitte Co. of Minneapolis was one of the cooperating firms in the evaluation. The staff of that firm has now compiled a cost and result analysis, a task necessitated by the many inquiries made from members of mill sanitation staffs.

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dosage started to take effect, a general methyl bromide fumigation was conducted.

5. Fumigant No. 3 with its outstandingly different composition was not formulated to produce a "quick-kill," but to serve as a residual fumigant primarily to prevent the propagation of insects. Consequently, the use of test cages containing live insects to record the mortality immediately following the fumigation is of no value to check this type of control. It is the constant long lasting effect maintained in stagnant cereal stock that is important. It is not uncommon to be able to detect the presence of Fumigant No. 3 in boot stock, as long as three (3) weeks from the date of its application.

6 To justify the above remarks, millers will recall that immediately following World War II, the most popular spot fumigant was Fumigant No. 2. It was deemed an excellent fumigant because it was a "quick-killer" that produced remarkably high mortalities in insect test cages.

Sanitation engineers of milling firms today appreciate the benefits of a quick killing fumigant when infestations get out-of-hand, but realize that the long-lasting control provided by a low vapor pressure fumigant that produces residual characteristics is the most important factor to get continuous control.

7. Sanitation engineers of milling firms who have regularly been using Fumigant No. 3 through the semi-automatic applicator are not able to understand why it was necessary to have general methyl bromide fumigations at all. For the information of those engineers, it should be pointed out none of the fumigants were applied into the rolls. It was felt that because the rolls were periodically cleaned, there was no need for fumigants in rolls. It is the firm belief of the writer that regardless of whether or not there were insects to be killed in the rolls that a void area resulted and could very easily have been the reason a general fumigation was necessary.

——BREAD IS THE STAFF OF LIFE——

Effect of Additives On Crumb Firmness

The ideal antifirming agent for bread, long sought by bakers to please customers demanding soft bread, is still awaiting discovery, but recent work on additives may open the way.

Several workers at the Northern Utilization Laboratory, Agricultural Research Service, U.S. Department of Agriculture, have studied several known antifirming agents and a number of compounds whose effect has not previously been reported. C. W. Ofelt, M. M. MacMasters, Earl B. Lancaster, C. L. Mehltretter, F. H. Otey and F. R. Senti investigated the action of monoglyceride at several different levels.

As spokesman for these workers, Mr. Ofelt told AACC that no antifirming action on bread crumb was found with diglycerides alone or in combination with monoglyceride. He reported on work with other additives and said, "The results indicate some of the effects of molecular structure on the antifirming action of the additive.

"The effectiveness of compounds derived from natural fats and sugars is news of the sort bakers like to hear," Mr. Ofelt continued. "The work reported should pave the way for more studies."

Two Views Given on Fine Particle Separation

Two views on fine particle separation were given during the 42nd annual American Association of Cereal Chemists meeting.

Ralph Gracza of Pillsbury Mills, Inc., Minneapolis, delivered a paper entitled "The Pillsbury Micro Milling Process." Mr. Gracza reported that "fine silks are capable of separating flour only in the upper half of the particle size range. Vortex air separations, on the other hand, do make good separations in the lower half of the particle size range." He also stated that "under the microscope we can distinguish chunks of whole and fractional endosperm cells, cell wall matter, free starch granules and fragment of protein in different degrees of freedom.

"To increase the yield and efficiency of the progress, especially adapted flour grinders are employed. These further fracture the endosperm into its chief constituents namely starch and protein matter."

Mr. Gracza also reported that startling transformations can be made and that research workers had "made bread flours from soft wheat and conversely cake flours from hard wheat. Turbo milling provides a tool for shifting not only protein, but also enzymatic activity, fat and even ash."

"It opens up the possibility of in-

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dustrial flours made by this turbo milling process, and Pillsbury Mills is active in this field."

"We already know that protein shifting is possible in cereal grains other than wheat. This is but one of the many things that we are studying at this time.

"The technical group working on this project is large. Some of the people are C. G. Harrel, Truman Manning, Arlin Ward and myself."

Second View

The second view was presented by David G. Elias in a paper prepared in cooperation with R. A. Scott. Both men are with Henry Simon, Ltd., Stockport, England.

Mr. Elias described the work of European researchers in protein concentration pointing to the work of Prof. Kurt Hess and the work of Hansen and Nieman which indicated practical aspects. Mr. Elias pointed out that in both hard and soft wheat flours "some free starch and a little of the protein matrix (broken down to small size by the normal milling process) will exist." He showed electron microscope slides illustrating "the relative shape and sizes of these particles."

The first slide showed a small starch granule having a diameter of 2.5 microns which was associated with a portion of the matrix. The second slide showed a typical piece of the material which has been termed "wedge" or interstitual protein.

Mr. Elias said: "From a consideration of the size and the structure of these particles it becomes clear that if a size separation can be made at a certain point, then the very small starch granules and the broken portions of the protein matrix will be found in the 'fines' fraction, whereas the agglomerated material and the larger free starch granules will be found in the coarse fraction and this should result in the displacement of the protein content. The cut size is well below that obtained by normal sifting methods of course, but a suitable machine for this purpose is the centrifugal air classifier in which the air drop forces can be counterbalanced by high centrifugal fields to give terminal velocity separations at a smaller size than was hitherto possible."

Mr. Elias indicated that in a laboratory this is possible with the "Bahco" Elutriator so that at a cut point of 15 microns one 3% fraction of 18% protein and the other 97% being coarse material of 9.7% from a 10% protein flour. He indicated that with specialized impact grinding combined with the separation a soft wheat flour could be separated into increased yield of high protein component. He pointed out that results depend largely on the basic properties of the original material soft wheat flours being easier to separate than hard wheat flours.

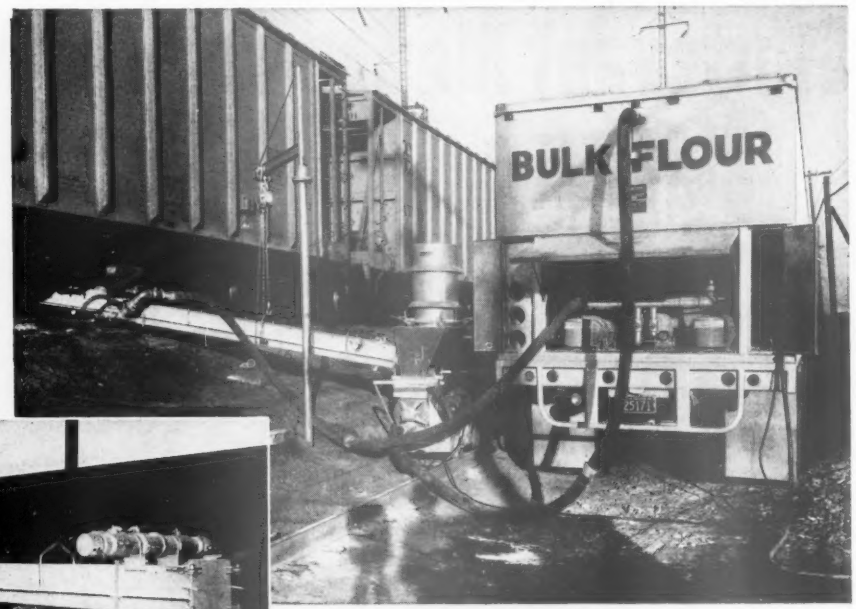
Slide Illustration

Mr. Elias showed a slide illustration which demonstrated that this protein component can be used as a fortifying agent in baking. Further remarks related that "the low protein or 'middle cut' fraction may well fulfill the requirements for specialty cake flours . . . while the medium proteins or 'coarse fractions' may have specialized value in biscuit manufacture . . ."

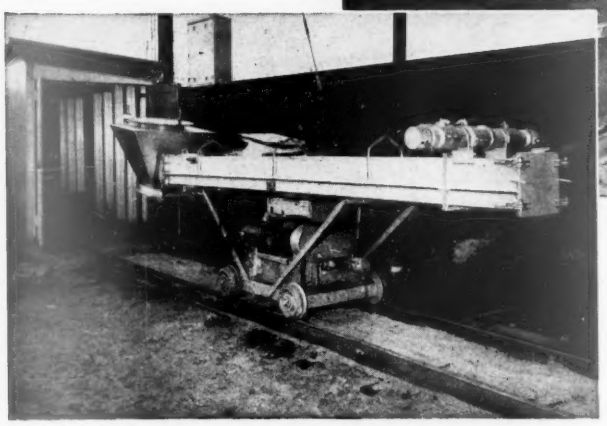
Mr. Elias also reviewed the trends in greater laboratory use of physical dough testing equipment particularly stress-strain types such as the Research Extensometer, the Brabender Extensograph and the Chopin Alveograph. Color measurements are increasing in use since the Kent-Jones and Martin flour Color Grader is being used more extensively as a quality control tool. Plans are being made for a continuous model which would be a step toward the automatic mill.

Mr. Elias pointed to the development of all metal low-head purifiers and the general use of metals, surplanting wood, which combined with pneumatic systems have transformed the milling technology. Conditioning was emphasized as an area of great promise for new information. He commented that temperature effects such as sending hard wheats to break rolls at 38°-48° C. rather than 18°-22° C. produced desirable effects such as larger bran particles and a softer, more plastic endosperm.

EN ROUTE—Thomas R. Aitken and C. John Dempster of the Board of Grain Commissioners, Winnipeg, are shown in conversation aboard the airplane carrying them to the 42nd annual meeting of the American Association of Cereal Chemists in San Francisco.



Clarke Bulk Transfer. Fuller Airslide transfer unit unloading flour from Airslide car to Fruehauf Airslide trailer. Mobile transfer unit is stored in shed when not in use.



Store Door Delivery, Inc. Fuller Airslide transfer unit conveying flour from Airslide car on elevated siding direct to Fruehauf Airslide trailer.

Fuller solves unusual bulk flour transfer problems

When it's conveying of bulk flour, Fuller engineers have the answer, as they had for Clarke Bulk Transfer for delivery to bakeries in the Philadelphia area. An isolated and almost forgotten railroad siding was selected and put to use. The unusual relationship of the siding with respect to highway level posed a problem . . . solved by a transfer unit, consisting of a combination of the F-H Airslide®, Airveyor® equipment, and Fruehauf Airslide trailer. The transfer unit, mounted on a four-wheel truck at highway level, is moved on a narrow gauge track and connected to an Airslide bulk flour car for transfer of the cargo to the Airslide trailer. When not in use the transfer unit is moved into a small storage shed.

Store Door Delivery, Inc. operates two Fruehauf Airslide bulk flour trailers serving three large bakeries in the New York Metropolitan area. Airslide bulk flour cars are spotted on an elevated track in the railroad yard. Rapid and sanitary loading of trailer is accomplished with the Fuller Airslide transfer unit conveying direct from cars to the trailer, illustrated on the left. A trailer of 20 tons capacity can be loaded in seven minutes.

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Progress in Breeding Bread Wheats in North America

In spite of today's flavorful bread, a thorough understanding of wheat quality is one of the most difficult problems that American agricultural scientists presently face. Dr. A. M. Schlehuber, Oklahoma A&M agronomist in charge of small grains research, said in a talk at the AACC meeting that not only are quality characteristics difficult to measure and interpret, but the tests are time-consuming and require expensive equipment.

"While important forward strides have been made in research during recent years," Dr. Schlehuber explained, "it is well known that people who use the flour of hard wheats are not always in agreement as to quality."

Dr. Schlehuber, who is employed jointly by A&M and the U.S. Department of Agriculture, gave consideration to both winter and spring hard bread wheats because of their importance in filling America's export needs and because they constitute a majority of the wheat produced in North America. Eighty per cent of the total amount of hard red winter wheat and 43% of the over-all amount of wheat produced in the U.S. comes from 11 of the Great Plains states, he pointed out.

The breeding for resistance to races of black stem rust was regarded by Dr. Schlehuber to be the primary objective of every important hard red spring wheat improvement program in the country.

Rust Hazard

"Consequently progress in breeding for quality must be considered in relation to this major hazard," Dr. Schlehuber declared. "Certainly if resistance to stem rust isn't considered in our breeding programs today, production likely would be so affected that no one would need to worry about the quality."

Quality characteristics of Ceres, Thatcher, Pilot, Rival and Mida wheats have revealed these varieties to have an equal or higher flour yield, protein content and loaf volume than the Marquis variety. Marquis, one of the oldest wheat varieties, still stands out as one of the greatest achievements in wheat-breeding history.

Marquis' quality characteristics for milling and breadmaking purposes have been referred to as the "yardstick of quality," Dr. Schlehuber stated.

But Glenn S. Smith, principal plant breeder in North Dakota, reports that most of the more recent varieties of hard red spring wheat would score rather high for quality in spite of the fact that Marquis was considered for many years to be superior, Dr. Schlehuber said.

Mixing Tolerance

However, Thatcher and Lee varieties, which are now widely grown commercially, are stronger in mixing tolerance and probably equal in most any other quality respect to Ceres and Marquis, the older varieties which they replace, Dr. Schlehuber quoted Mr. Smith as saying.

Pointing to the importance that is being placed on quality wheats, Dr. Schlehuber related the fact that Cimarron, produced by the Oklahoma Agricultural Experiment Station for release in 1947, was not released because of its inferior quality. Another similar case is with Willet, a variety developed by the Minnesota Experiment Station, which is being held because of its inferior quality characteristics.

"In fact," Dr. Schlehuber said, "Selkirk is the only variety available to farmers which is resistant to the 15B form of stem rust."

However, Conley, a variety released by the North Dakota station in 1956, has even a higher degree of 15B resistance than Selkirk and is about equal to Lee in milling and baking characteristics, Dr. Schlehuber pointed out.

"Concho, which was released from the Oklahoma station in 1954, appears to have the widest range of adaptation of practically any hard red winter wheat released in recent years and its quality stands up well.

Emphasis on Quality

"More and more emphasis in research is turning to quality," the scientist explained. "Presently the North Dakota station is working on a wheat meal test which seems promising for yielding preliminary information on flour-milling attributes and dough characteristics.

"The Grain Research Laboratory at Winnipeg, Canada, has continued to push research on the develop-

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ment of methods for assessing quality, but reports from the station indicate it has not reached a markedly advanced stage."

The Canadian station reports there has been too much emphasis placed on very small scale quality tests (5-10 grams).

"We hope to expand our breeding programs and do more earlier quality testing," A. B. Campbell of the Canadian breeding laboratory was quoted by Dr. Schlehuber as saying.

"And although the quality work at the Oklahoma station is relatively new, search is now under way for the development of more methods for evaluating and assessing quality," Dr. Schlehuber stated.

——BREAD IS THE STAFF OF LIFE——

Commercial Potential Of Ionizing Radiations

Ionizing radiation has a definite place as a third dimension in food preservation, along with heat and refrigeration, Wolfgang Huber, San Francisco consultant, reported.

Areas of usefulness in the cereal industry are primarily insect eradication and extension of useful shelf life, Mr. Huber said. The appropriate dosage has been established that will kill eggs, terminate larval development, and sterilize adults of all representative species of cereal-infesting insects, Mr. Huber said.

"The pronounced sensitivity of insect eggs to ionizing radiation makes this method particularly attractive in view of the shortcomings of fumigation and mechanical methods in this respect," Mr. Huber continued. "Cereal and fruit bars, brownie and gingerbread mixes and other cereal products, after irradiation, have been stored at 100° F. for periods up to one year, with no trace of insect life detectable at the end of the storage period, and no significant changes in quality of product. Irradiated flour also remained insect-free after 9 months of storage at 100° F. and, when subsequently used in baking produced entirely normal doughs and loaves."

Method Explained

To explain a proposed method for such irradiation Mr. Huber said that two cross-fired electron accelerators operating 8 MeV and 4KW each could handle about 60 tons of grain an hour, passing through the radiation field as a layer 3.8 in. thick. This source will be the only one available for food processors for some time to come.

Appropriate doses as now determined, he continued, "will reduce bacteria, molds, and yeasts by 95 to 99% and thus extend shelf life of many fresh and prepared food products, particularly if they are kept refrigerated after irradiation to prevent germination of any remaining spores." Cereal and bakery items so handled include prepackaged, partially baked rolls, waffles, etc., as well as fully baked bread and cake: these have remained free of molds and bacteria for weeks after irradiation. "Flavor, color, or texture changes are slight or completely absent," Mr. Huber said.

A testing program under the surgeon general of the Army (with Food and Drug Administration guidance) to investigate effects of irradiation of foods was described. After a thorough test on animals and with human volunteers, no indication has been found that irradiation sterilization impairs the wholesomeness of food either immediately or by subtle long-term changes, Mr. Huber stated.

Explaining some of the economic aspects of ionizing radiation of foods, Mr. Huber said that where penetration of 1 inch into foods is sufficient, processing costs are about 1.3¢ a pound for sterilization, .2¢ for shelf-life extension, and .02¢ for insect eradication. He cited comparable costs of heat preservation, .2 to .5¢, and freezing, .4 to .7¢. "It appears, then," he said, "that for some applications costs for irradiation preservation of foods are getting at least into the same ball park with costs for conventional methods. In such a new field, this is no mean achievement."

Mr. Huber described a strongly promising outlook for ionizing radiation. "The demand for convenience foods is steadily on the upswing," he said. "It has been predicted that within 10 to 15 years, 5 to 10% of our consumer foods will have undergone irradiation in one way or another; this means a $4 to $7 billion potential — big business whichever way one looks at it.

"The food industry has been called a sleeping giant. Awake, this giant could bring about untold wonders," Mr. Huber declared. "Irradiation as a third dimension in food processing may well become an important tool in welding the industry into a smaller number of strong autonomous units, maintaining their own dynamic force in the pursuit of progress."

——BREAD IS THE STAFF OF LIFE——

Fight for Pure Foods and Drugs

Pending national legislation needs the solid support of the food industry and the public to ensure the safety of new chemicals for use in foods. Charles W. Crawford, former commissioner of food and drugs, told AACC that legislation sponsored by the baking, milling, and other food

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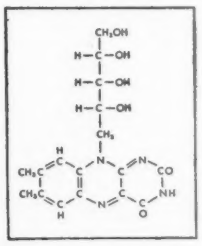
INSIDE SCIENCE

The Vital Story

A Quick History. Independent investigators, working separately to unlock several of nature's doors, sometimes open up unsuspected relationships. This happened with vitamin B_2.

Investigations. About 25 years ago, several groups, notably Warburg's, were investigating a "yellow enzyme" obtained from yeast. Almost simultaneously other investigators were studying a food factor that aided growth of laboratory animals.

What they found. Proceeding with chemical analysis of this growth factor, the team of Kuhn, György, and Wagner-Jauregg noted a relationship between the growth-producing agent and the "yellow enzyme." Their findings, and those of other researchers along similar lines, were published in 1933. Eventually, riboflavin and an essential part of the yellow enzyme were found to be identical and the unity of an essential nutrient and cellular metabolism was established.



Isolation of pure riboflavin was achieved by Kuhn and his co-workers, and by Ellinger and Koschara, in 1933.

Nomenclature. Known in the United States as riboflavin, this vitamin has also been called lactoflavin, ovoflavin, hepatoflavin, and vitamin G.

SYNTHESIS

By 1935, two eminent chemists, working separately, had synthesized riboflavin, practically in a dead heat. Prof. Paul Karrer of the University of Zurich, a collaborator of the Hoffmann-La Roche Laboratories, produced the first successful synthesis. Five weeks later Richard Kuhn of Germany announced his synthesis of the vitamin. Prof. Karrer subsequently shared the Nobel Prize in Chemistry for his work in vitamins and carotenoids.

The Karrer synthesis forms the basis for chemical processes in widespread use today by Hoffmann-La Roche and other leading manufacturers throughout the world. Riboflavin is also manufactured today by fermentation methods.

CHEMICAL AND PHYSICAL PROPERTIES

Riboflavin is yellow, slightly water-soluble with a greenish fluorescence and a bitter taste. Its empirical formula is $C_{17}H_{20}N_4O_6$. Vitamin B_2 produced by the Roche process is identical in every way with that occurring in nature.

How does vitamin B_2 work? Riboflavin is a vital part of nature's chain of reactions for utilization of carbohydrate energy. It has been found to be a constituent of many enzyme systems and is thus intimately connected with life processes. It is probably required by the metabolic processes of every animal and bird as well as by many fishes, insects and lower forms of life. (In certain animals, however, the requirement may be synthesized by bacteria within the intestine.)

In the cells riboflavin goes to work attached to a phosphate group. This substance, known as riboflavin-5′-phosphate or flavin mononucleotide, may in turn be attached to still another essential substance, adenylic acid, forming flavin adenine dinucleotide. Either nucleotide then is attached to protein, thereby forming an enzyme, and takes its part in oxidation-reduction reactions.

Requirements in Human Nutrition. As we have seen, vitamin B_2 is essential to life. We have no special storage organs in our bodies for this vitamin, although a certain level is maintained in various tissues, with relatively large amounts found in the liver and kidneys.

MEASURING METHODS

In the beginning, riboflavin activity was described in "Bourquin-Sherman units" and requirements were thought to be very small. Subsequent research showed otherwise. Milligrams of weight became the unit and the Food & Drug Administration of the U. S. Dept. of Health, Education & Welfare has established a minimum daily requirement of 2.0 mg. of riboflavin for all persons 12 or more years old. For infants it is 0.5 mg. These requirements are designed to prevent the occurrence of symptoms of riboflavin deficiency disease. The minimum daily requirement for this vitamin for children from 1 to 12 years has not been established by the F. & D. A.

Recommended allowances. The Food & Nutrition Board of the National Research Council has recommended the following daily dietary allowances of riboflavin, expressed as milligrams. These are designed to maintain good nutrition of healthy persons in the U. S. A.

		Boys	Girls
Men		1.6	
Women		1.4	
"	(3rd trimester of pregnancy)	2.0	
"	(Lactating)	2.5	
Infants, 1-3 months		0.4	
" 4-9 "		0.7	
" 10-12 "		0.9	
Children, 1-3 years		1.0	
" 4-6 "		1.2	
" 7-9 "		1.5	
Adolescents, 10-12 years		1.8	1.8
" 13-15 "		2.1	2.0
" 16-20 "		2.5	1.9

industries has been before Congress for six years and that no action has been taken.

Mr. Crawford stressed the danger of delay in enacting this law. He recalled the tragic deaths of 100 persons in 1938 from poisoning by an "Elixir of Sulfanilamide" containing a dangerous untested ingredient. This dramatized the need for passage of the present Food, Drug and Cosmetic Act and was responsible for the section requiring safety testing of new drugs, Mr. Crawford stated. "It is foolish to assume," he said, "that the food industry is immune from the sort of wholesale tragedy that resulted in the passage of the new drug section."

Mr. Crawford praised the industry for its past wholehearted support of laws in the public interest. He said that at least 95% of food manufacturers and processors could be counted on to use more care than the law would require in protecting the consumer's health. The remaining 5% he termed "adventurers, untrained for their jobs or indifferent to consumer welfare, who are less careful and who may prematurely launch competitive products at the risk of consumer health." Consumer protection similar to that provided in the use of new drugs is needed against that small minority, he said.

In urging the food industry to support increased appropriations for enforcing food and drug laws, Mr. Crawford said, "neither the public nor industry has yet received the potential benefits of food and drug legislation now on the books." He revealed that the public pays only 4¢ per capita annually for the present inadequate service and that the 100,000 factories and warehouses subject to the law can be inspected at the average rate of only once in about seven years.

Increased funds would enable the Food and Drug Administration to take more effective action against food quacks who "discredit the integrity of our general food supply and of its makers" by false claims that basic foods do not supply nutritional requirements. "These unlicensed practitioners of the healing art" can cause injury and death by persuading consumers to rely on food supplements as cures for serious illness, Mr. Crawford said.

——BREAD IS THE STAFF OF LIFE——

# of VITAMIN B_2 *by* Science Writer

(Riboflavin)

Deficiencies of vitamin B_2 appear in several ways in human beings. The eyes, the skin, the nerves, and the blood show the effects of too little riboflavin. Laboratory animals have demonstrated that a riboflavin-deficient diet can cause death of adults and can slow or stop growth in the young. Female animals, deprived of riboflavin in the diet, may produce offspring with congenital malformations.

Medical uses. To overcome and control deficiencies in human beings, physicians have pure riboflavin available for administration by injection or orally, by itself or with other "B" vitamins or multi-vitamin-mineral combinations.

How do we get our daily riboflavin? Vitamin B_2 has wide distribution throughout the entire animal and vegetable kingdoms. Good sources are milk and its products, eggs, meats, legumes, green leaves and buds. Whole-grain cereals have significant but not large amounts of riboflavin.

ADDITION TO FOODS

Cereal foods play a large part in our diet. To produce the white flour almost all of us want, millers are obliged to remove parts of the wheat that contain much of the grain's riboflavin and other nutrients. In addition, cereal grains are not rich sources of riboflavin. Millers meet this problem by *enriching* the grain foods for which federal standards exist with vitamins B_1, B_2, niacin and the mineral iron. In the case of vitamin B_2, however, they do more than *restore* the processed food to its natural riboflavin level; they *fortify* the food with enough of this essential vitamin to make it nutritionally more valuable than it was in nature.

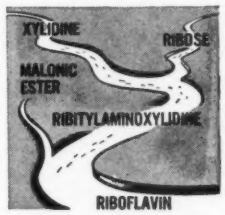
Acting to protect the good health of millions of Americans, bakers and millers adopted *enrichment* of white bread and white flour in 1941. Since that time, other foods, such as macaroni products, corn meal and grits, farina, pastina and breakfast cereals have had their food value increased by enrichment with pure riboflavin and other vitamins and minerals.

When enriching, fortifying or restoring, food manufacturers add the necessary quantity of riboflavin (and other vitamins and minerals) to the food during processing, so that the finished product meets federal, state, and territorial requirements or contributes to the consumer an amount of the vitamin that dietary experts believe significantly useful.

PRODUCTION

Prof. Karrer's synthesis of riboflavin was a laboratory success. Adapting the process to commercial production, however, demanded original thinking by chemists at Hoffmann-La Roche. The production of riboflavin by chemical synthesis requires the production of ribose, a rare sugar, at an early stage in the process. This special sugar must be made inexpensively if the synthesis is to be practical. Sugar chemistry is a difficult matter. In a brilliant piece of work, the Roche chemical experts developed a method to produce ribose on a commercial scale by an electrolytic process, thus overcoming a most troublesome problem. Subsequently, Roche chemists developed the first practical synthesis for riboflavin-5′-phosphate, identical with natural flavin mononucleotide.

Picture three streams joining to form a river and you have a simplified idea of the Roche process for synthesizing vitamin B_2. O-xylene and glucose are processed separately to form xylidine and ribose respectively. These are joined to form ribitylxylidine, which is then converted to ribitylaminoxylidine. Starting separately with malonic ester, which is processed through intermediate stages to alloxan, the third "stream" is then joined with ribitylaminoxylidine to form riboflavin. Purification occurs at each step of the synthesis. Riboflavin 'Roche' equals or exceeds U. S. P. standards.



By the tons. So efficient is the Roche process that pure riboflavin is produced *by the tons* for use in pharmaceutical products and processed foods. An interesting development by Roche is the production of riboflavin in different forms related to the method of end use. 'Roche' Regular riboflavin U. S. P. is especially useful in dry enrichment premixes, powdered dietary supplements, pharmaceutical tablets and soft gelatin capsules. 'Roche' Solutions type is preferred for the manufacture of solutions having low concentration. 'Roche' Riboflavin-5′-Phosphate Sodium is a highly and rapidly soluble riboflavin compound favored for all pharmaceutical liquid products and some tablets, lozenges, and capsules. It has a more pleasant taste than the bitter U. S. P. riboflavin.

This article is published in the interests of pharmaceutical manufacturers, and of food processors who make their good foods better using pure riboflavin 'Roche.' Reprints of this and others in the series will be supplied on request without charge. Also available without cost is a brochure describing the enrichment or fortification of cereal grain products with essential vitamins and minerals. These articles and the brochure have been found most helpful as sources of accurate information in brief form. Teachers especially find them useful in education. Regardless of your occupation, feel free to write for them. Vitamin Division, Hoffmann-La Roche Inc., Nutley 10, New Jersey. In Canada: Hoffmann-La Roche Ltd., 286 St. Paul St., West; Montreal, Que.

Unlimited Opportunity For Cereal Chemist

With per-capita consumption of flour down because of a higher standard of living plus abundance and attractiveness of other foods, the cereal chemist and the miller are challenged to increase that consumption, A. A. Ackels, Sperry Operations manufacturing superintendent, General Mills, Inc., reported. Mr. Ackels pointed out opportunities, a fundamental one being the increased population which has held consumption of cereal foods relatively constant despite lowered per-capita use.

Attractiveness and price of cereal products are controlled largely by the technical people — the cereal chemists and the millers — Mr. Ackels said. Control is centered in areas of product design, production and inspection.

Automation in milling and some of its more recent evolutionary changes were reviewed by Mr. Ackels. In pneumatic milling, advantages are cool stock, improved sanitation and possibilities for greater efficiency; problems relate to dry stock and sensitivity to overloads. Prebreaking of wheat in the flour mill, explained as primarily a flow extension, is of advantage to short-system or overloaded mills from a yield standpoint, Mr. Ackels stated. Economic advantages of bulk flour handling and the facilities usually employed for it were discussed.

"Progress in the feed industry has been little short of sensational," Mr. Ackels declared. "In three decades the industry has become the seventh largest, and dollar-volume growth in 27 years has been tenfold." As an example of this justifiable growth marked by results attained in feed conversion by poultry and livestock, Mr. Ackels cited phenomenal improvements in broiler production.

"Opportunities are unlimited," Mr. Ackels said. For the cereal chemist, he pointed to possibilities in baking tests and increased knowledge concerning enzymes; for the miller, yield improvement potentials and further mechanization.

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Conditioning North American Wheats

Conditioning of wheat, commonly practiced in Europe, is becoming more usual in the U.S. with the object of achieving optimum millability of North American wheats. Peter Goldberg of MIAG Northamerica, Inc., Minneapolis, clarified the position of this process in delivering a paper by Heinz Gehle and Heinz Cleve, Miag Corp., Braunschweig, Germany.

In Europe, Mr. Goldberg told the cereal chemists at their 42nd annual meeting—and especially in countries prohibiting the addition of chemicals to flour—the aim of conditioning is predominantly to improve the baking quality of weak wheats. North American wheats are adequate in baking strength and quality.

"Conditioning aims at improvement of wheat by easing the separation of bran from endosperm, producing a tough bran coat and thereby bigger bran flakes which are easier to clean out, obtaining optimum mellowing of endosperm structure, and achieving for the milling process optimum and even moisture content, as rapidly as possible," said Mr. Goldberg.

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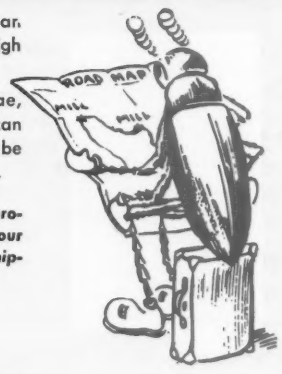

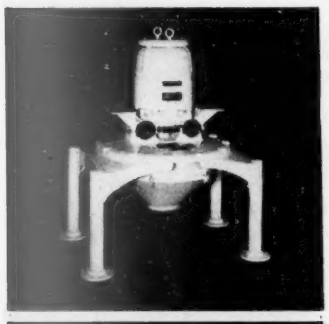

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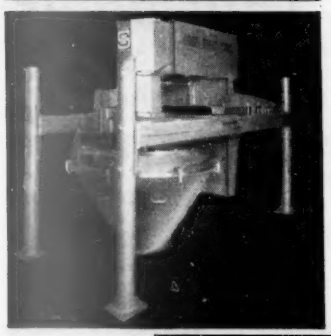

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over 30 years of conditioner application, Mr. Goldberg suggested separate conditioner treatment of hard wheat (high quality), medium (fill-in) wheat, and soft wheat (used in Europe for bread flour). Conditioned hard wheat requires less tempering bin space, and endosperm structure is mellowed evenly and to the optimum extent, he explained.

"Experience with wheat conditioning in Europe suggests these economic advantages in improved millability of wheat, reduction of tempering time; increasing flour recovery through changing the grain structure; clear separation of bran from endosperm, and thus producing more patent flour of better baking quality," concluded Mr. Goldberg.

——BREAD IS THE STAFF OF LIFE——

Lack of Weed Control Cuts Manitoba Crop

Noxious weeds cut the 1956 value of Manitoba's field crop production by an estimated $45,000,000, an average of about $1,000 per farm, according to Dr. George Friesen, of the University of Manitoba's plant science department.

Dr. Friesen selected 50 fields at random throughout the Red River valley, all within a 60-mile radius of Winnipeg. Twenty plots were staked in each field, and half were kept weed free by hand-weeding each week. He reported that the average yield reduction of non-weeded plots compared to weeded plots was 15.9%. This, province-wide, translates into a loss of 42,000,000 bushels with a value of $45,000,000, based on an average price for the total wheat, oats, barley and flax yields from Manitoba farms. Chief reason for the reduction is the competition of weeds to the growing crops.

Further financial loss, Dr. Friesen said, was experienced when dockage, lower grades, cost of summer fallowing, herbicides and increased harvesting problems are considered. He said farmers must make a determined effort to control their weeds if they hope to increase cash returns from field crops.

——BREAD IS THE STAFF OF LIFE——

John R. Thompson Joins V-C Bag Division

RICHMOND, VA.—John R. Thompson has joined the V-C Bag Division of Virginia-Carolina Chemical Corp. as sales coordinator, according to D. Harold Johnson, division manager. He will make his headquarters at 99 Park Ave., New York.

In making the announcement, Mr. Johnson said the position of sales coordinator has been created as a part of the V-C Bag Division expansion program.

Mr. Thompson has had 20 years experience in the industry, and will be responsible for customer relations, product development, technical service and marketing. He will work closely with V-C sales manager Walter B. Gillette. He comes to V-C from Union Bag-Camp Paper Corp. where his responsibilities included sales training and marketing. Previously he served as Union's headquarters sales manager.

——BREAD IS THE STAFF OF LIFE——

ELEVATOR COMPLETED

PRESTON, MD.—Construction of a grain elevator with an 11-carload storage capacity has been completed here by the Caroline Supply Co. The elevator, which can handle 2,000 bu. of grain an hour, is managed by John and August Rieck.

Effects of Oxygen On Flour Doughs

New findings that may be of considerable importance to the breadmaking process were reported to AACC by scientists working at General Mills, Inc., research laboratories, Minneapolis. Those attending the meeting were told of work carried on by D. E. Smith, J. P. Van Buren, and J. S. Andrews. The scientists were continuing with previous findings at the laboratories, that flour doughs utilize a considerable amount of oxygen during mixing, and that this oxygen is taken up by unsaturated fatty acids such as linoleic acid, contained in the flour.

"It has now been found," Mr. Smith said, "that among several effects of oxidation of these fatty acids by oxygen, a considerable change can result in the mixing properties of flour doughs in the presence of reducing agents; oxidized fatty acids tend to counteract the effect of reducing agents upon doughs."

Further, Mr. Smith stated that with removal of fatty acids from some doughs, there is less loss in dough strength as mixing time is increased. "The presence of oxidized fatty acids in doughs appears to contribute to breakdown in dough structure during mixing," he said. "A third effect is that oxidation of fatty acids during dough mixing is also involved in the oxidation of sulfhydryl compounds in the flour."

These effects are all interrelated and of probable importance, but the exact practical significance of the findings to the breadmaking process will require further experimentation, according to Mr. Smith.

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CEREAL CHEMISTS' ROLE

(Continued from page 1a)

crease in symptoms of vitamin C deficiency has been observed. There can be no question but that a great many people throughout the country and in all walks of life choose diets that without enrichment would be somewhat deficient in one or more of the nutrients supplied by enriched grain products. It seems very likely that cereal enrichment has contributed much more to the health of the nation during the past 16 years than it has been given credit for or than can be proved statistically.

Have we as cereal chemists, working with our colleagues the human nutritionists, now exhausted the possibilities in pointing the way toward better nutrition through cereal products? This is a difficult question to answer, but it seems quite possible that we have only scratched the surface and that research in human nutrition now underway may open broad new fields for health improvement and an increase in useful life span through diet.

The refinement of cereal grains through milling results in food products more palatable and digestible than whole-grain products. At the same time, however, the vitamins and minerals are largely removed. In our present enrichment plan thiamine, riboflavin, niacin and iron are restored to the refined mill products used for food in amounts prescribed by the Food and Drug Administration's definitions and standards of identity for enriched flour, bread, corn meal, corn grits, farina, and macaroni products. The addition of calcium and vitamin D is also permitted. These vitamins and minerals are the ones about which we have the most information in respect to human requirements and that are likely to be deficient in the diet. They are also ones that can readily be incorporated into cereal products.

Other Vitamins

Whole grains contain other vitamins and many other minerals that are largely removed in milling. Many of these are nutritionally essential. Some of them need not be considered as possible food enrichment ingredients since they are amply supplied by most any diet. There are other vitamins and minerals, however, about which we need more information in respect to human requirements and possible deficiencies in the diet. Some of these are now being used in proprietary pharmaceutical products and even in a few food products. Vitamin and mineral preparations for direct consumption serve a useful purpose, but, unfortunately, are used least by those persons who need them most. The proper incorporation of these materials into foods such as grain products provides the best and most economical means of getting them to where they will do the most good.

Among the essential nutrients that may find greater use as food supplements are vitamin B_6 (pyridoxine), vitamin B_{12}, copper and cobalt. Certain essential amino acids, particularly lysine, should also be mentioned. All of these nutrients could readily be incorporated into cereal products, but more should be known about their need and their limitations before greater use is made of them.

Present enrichment requirements as defined in the Food and Drug Administration's definitions and standards of identity are based on sound nutritional principles. Great care must be taken to make sure that the incorporation of any additional ingredients into enriched foods is based on equally sound principles. Any attempt to enrich grain products with additional ingredients solely for the advertising appeal such additives might have would lead to charges of quackery and would tend to discredit the whole enrichment program. We, as cereal chemists, must exert our leadership in discouraging any such exploitation.

No vitamin, mineral, or other nutrient should be added to any food solely for the purpose of nutritional improvement unless convincing evidence is available (1) that it will benefit a certain segment of the population by minimizing or correcting a specific dietary deficiency, and (2) that it will not create any harmful excess of the nutrient in the diet of any segment of the population already receiving an adequate or more than adequate intake of the nutrient through normal dietary channels. Any nutrient not conforming with these two criteria should be sold in drugstores, not food stores.

Heart Disease

Coronary heart disease is the No. 1 killer in the U.S. and in many other parts of the world. Until recently this scourge was considered to be the inevitable consequence of aging, hastened by the tensions and strains of modern living. Preventive measures were limited largely to easing of nervous tension and avoidance of overwork after the age of 40 or 50. Then came the surprising observation that during the latter years of World War II in Germany and other war-torn countries the death rate

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The purpose of Dusta-Cide is to protect the immediate surface of the grain from outside infestation. The grain surface is liable to infestation by migrating insects such as weevil, bran bugs and especially flying moth. The Dusta-Cide barrier prevents migrating insects from establishing an infestation.

Because Dusta-Cide covers only the immediate surface, the bin to be dusted must either be free of infestation or previously fumigated. Hence, the best time to apply Dusta-Cide is after completion of transferring and/or fumigation; or, if you are threatened by moth, before they get started. Thus, an ideal time for dusting is spring or early summer. Then, by preventing surface reinfestation, Dusta-Cide can eliminate the need for repeated fumigations.

Application is simple. The only requirement is that the dust should cover the entire grain surface evenly. If the surface is later disturbed, such spots should be redusted.

For best application we have designed both a compressed air duster and a motor-driven applicator. (The latter is for sale or rent.) Or, a duster can be adapted from a vacuum cleaner. Also, on a limited scale, you can even dust by hand.

Dusta-Cide costs 30c per pound in 100-pound fiber drums. Standard dosage is 4 pounds per hundred square feet. On a round bin you find surface area by multiplying diameter by diameter, and then multiplying by 8/10. Thus, on a 20-foot diameter bin, surface area would be about $20 \times 20 \times 8/10 =$ 320 square feet, and dosage would be about 13 pounds of Dusta-Cide at a cost of around $4.00. This is only a fraction of the average cost of refumigation.

In closing, remember that Dusta-Cide is not a substitute for fumigation. The grain should be practically free of infestation before Dusta-Cide is applied. However, one application of Dusta-Cide, if undisturbed, will give protection for a full storage season. This is not just a sales claim. Dusta-Cide has been doing just this for the past 4 years.

Dusta-Cide
Compressed Air Applicator

For use where compressed air is available. Equipped with plastic 1-gallon jar holding 4½ lbs. Dusta-Cide. Discharges in 1 min. Wt. 7 lbs. **$32.50** F. O. B. Kansas City

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from coronary heart disease dropped sharply in the face of the fact that the populations were subjected to greater nerve strain and overwork than were perhaps ever experienced in the history of man. At the same time, however, the diet of the civilian population was of necessity greatly restricted, particularly in respect to its fat content, since fats and oils were almost unobtainable. Later investigations have shown statistically highly significant relationships between dietary fat, blood cholesterol levels, atherosclerosis due to cholesterol deposits in the coronary arteries, and death rates from coronary heart disease among different population groups. All of this proves nothing, but it does point a warning finger of suspicion at excessive dietary fat as a possible important factor in the heart disease problem. Since fat consumption in the U.S. is the highest of any country in the world (about 40% of the total caloric intake) and the death rate from coronary heart disease is likewise the highest in the world, we should be particularly interested in the outcome of current research in this field.

Although all fats have been under suspicion, it now appears that there may be great differences in the behavior of different kinds of fat in the diet. The more saturated fats appear to increase blood cholesterol levels, while the relatively unsaturated fats may act quite differently and in some instances have been shown to reduce blood cholesterol levels. There is some evidence that cereal fats, and particularly corn oil, may be unusually effective in reducing blood cholesterol, more so than other unsaturated vegetable fats of similar chemical composition. Perhaps some substance in corn oil other than glycerides is responsible for this surprising effect. The apparent superiority of corn oil in this respect, however, needs further confirmation before it can be fully accepted.

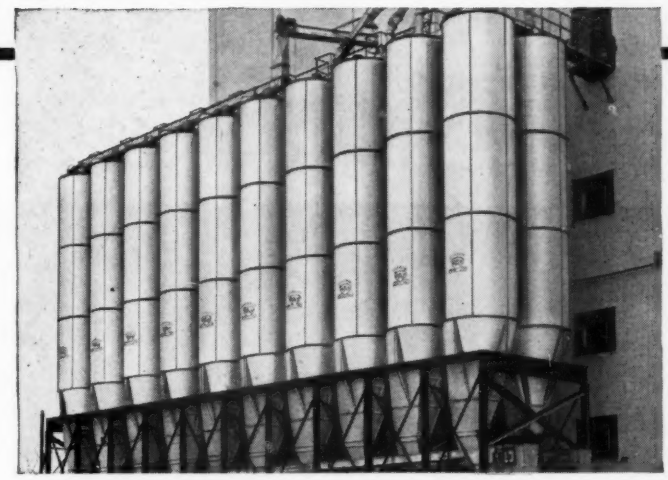
Although much remains to be learned concerning the effect of dietary fats on the chain of events that leads to heart disease, the grain and allied industries, and we as cereal chemists, will do well to follow closely all developments in this fascinating and highly important field of research. If some of the current indications are confirmed by further research, the impact on the cereal industry may be very great indeed.

Reduction in Fat

Some nutritionists are already advising a substantial reduction in fat intake for all persons of middle age and beyond. Even though such advice may be premature, it can probably be given without fear of harm since in some countries low-fat diets

Cut Material Handling Costs with

DAY BULK MATERIAL TANKS



Each of these DAY vertical bulk material tanks has an approximate storage capacity of one carload. They serve as storage tanks for a packaging line as well as for truck and railcar loading. Every day more and more plants find large quantities of dry bulk materials can be handled more economically using DAY bulk material tanks. They save labor, containers and storage costs.

DAY bulk material tanks are made of black iron, galvanized or stainless steel. They are built and shipped in *easily erected, bolted sections*. Vertical tanks are furnished in sizes from 3 to 14 feet in diameter, up to 100 feet high. No support is required above the cone level. Patented, suspension discs are available for vertical type tanks to prevent bridging and assure free flow of product.

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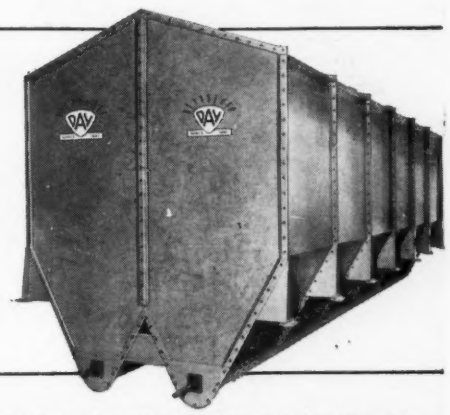

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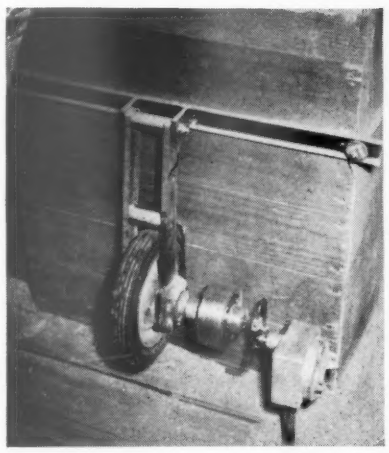

Showing installation of control with rubber-tired wheel assembly. Wheel rides against back side of elevator leg belt.

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are the rule and do not appear to have any undesirable effect. Some fat is necessary, of course, to supply the nutritionally essential fatty acids and to act as a carrier of the fat-soluble vitamins.

Any substantial reduction in fat consumption will, of course, be compensated for by a corresponding increase in consumption of other foods and there is no reason why cereal foods should not account for a good part of this increase. Here may be a real opportunity for the grain industry to expand and in so doing to benefit not only itself but the public as well. Grain products have a clean bill of health in the fat controversy because they are low in fat content, and the fat they do contain is of the type that appears beneficial and supplies nutritionally essential fatty acids.

If corn oil should indeed prove to be unique in its ability to control blood cholesterol levels favorably, a greatly increased demand for it could be anticipated unless the active ingredient could be isolated and readily supplied from other sources. Corn yielding two or three times as much oil as the common commercial varieties has been developed through breeding and could be produced in quantity if the demand should arise.

The baking industry should pay close attention to current research on fat metabolism, since large quantities of fats are used in many bakery products. If present theories are confirmed, demand for either low-fat bakery products or products containing relatively unsaturated fats can be anticipated. Shortening manufacturers may be called upon to supply shortening containing substantial quantities of unsaturated glycerides or perhaps some other substance such as the hypothetical active ingredient of corn oil that may be found to have a favorable influence on fat metabolism.

We are living in a rapidly changing world, but with all these changes food remains and will continue to remain the prime basic necessity of all mankind. We as cereal chemists represent the most important food industry in the world, since cereal products constitute the world's principal source of food. We shall be called upon more and more to conduct research and provide scientific advice and service that will benefit the producer, the processor, and the consumer of our products. Science is gradually pulling away the veil that shrouds many of the remaining mysteries of life. We can look forward with confidence to better and longer lives, made possible in no small part by a fuller understanding of human nutrition. Let us keep our eyes wide open and our ears to the ground so that we may contribute our share to the better world ahead.

MEDAL WINNER

(Continued from page 1a)

under closely controlled conditions from 30 g. samples. Vacuum mixing, hydraulic extrusion. and precisely controlled drying schedules are features of this equipment.

In basic research the key problem has related to the yellow color of macaronis which is of paramount commercial importance on this continent. It was early established that varieties with similar yellow pigment contents did not necessarily produce macaronis of the same color. Dr. Anderson gave an interesting account of the search for the "missing factor," undertaken mainly by Dr. G. N. Irvine.

This factor turned out to be an enzyme, lipoxidase; poor varieties tend to have high lipoxidase activity and thus lose much of their pigment during processing. In the course of research involving the elaboration and verification of the lipoxidase hypothesis, small-scale methods for determining the activity of the enzyme were developed and are now widely applied in the durum breeding program and in assessing quality of commercial samples of durum wheat.

Other phases of durum quality that have been investigated at Winnipeg relate to browning of macaroni, effects of bubbles on appearance, and dough properties which affect the extrusion process. Work in this field has recently been curtailed to permit transfer of staff to other work.

Bread Wheat

In dealing with bread wheat, Dr. Anderson emphasized that the phenomena in this field have been widely observed and recorded. He said, "We know a great deal about the behavior of flour and dough, but our knowledge is largely empirical; it is based on observation rather than on understanding of fundamentals. Accordingly, as always happens under similar circumstances, our ability to predict is severely limited."

In his opinion, the key problem involves the biochemistry of dough. "We shall not make substantial advances in assessing the quality of flour or wheat until we understand the chemical reactions that underlie the peculiar physical behavior of dough." A team of investigators, including a biochemist, an analytical chemist, a physical chemist, and a physicist, has been concentrating on this problem and "refusing to be drawn aside to other possibilities of research no matter how attractive." A three-pronged attack has been developed, rheological (study of physical properties), analytical and sorption. The investigations have been

Some of those groceries would be as out of date today as the rumble seat itself! As you know, new processing methods, new packaging, new ingredients have changed many food products.

Even staples like family flour have been improved, thanks to vitamin enrichment. Today, food buyers *expect* food products to carry the "ENRICHED LABEL".

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PFIZER BI-CAP has recently been improved through vitamin research. It is now a lighter color enrichment mixture with an even dispersion that overcomes unsightly agglomeration. All three forms of BI-CAP are also made with thiamine mononitrate for Better Vitamin B_1 stability.

Continued Pfizer research in riboflavin, thiamine and other nutritional additives such as amino acids will help you offer improved flour for tomorrow's improved bread and baked goods. Look to Pfizer for the finest enrichment concentrates.

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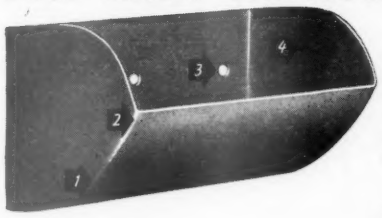

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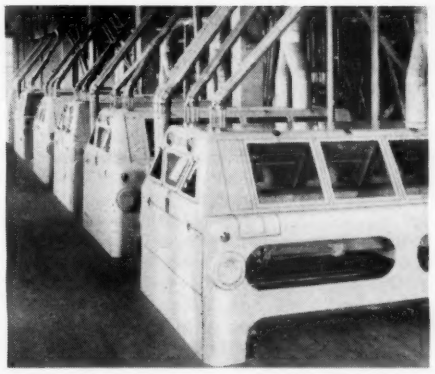

Type PHm Purifiers in the plant of the Ellison Milling and Elevator Co., Ltd., of Lethbridge, Alberta.

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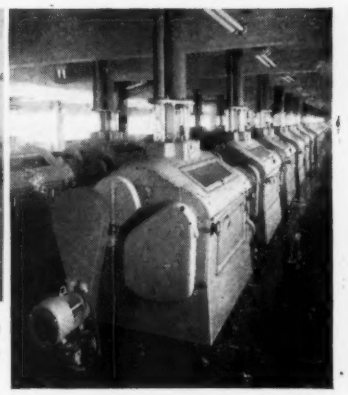
Heart-of-the-mill trio



(Above)
The "Pneu-Roll" roller floor in the new O.T.K. plant Hameenlinna, Finland.

(Above Left)
Type PSm square-sieve Plansifters—also in the new O.T.K. mill.

Robinsons have now completed the redesigning of their three basic machines.

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made principally by Drs. I. Hlynka, D. K. Cunningham and C. J. Dempster.

Dr. Anderson said that those who have followed recent work at Winnipeg might think the laboratory is primarily interested in the rheology of dough and in studies of potassium bromate and other commercial bread improvers. The laboratory is not interested in either per se, but considers them only as tools for studies having a more fundamental objective.

The rheological attack gained impetus from measurements of stress at constant deformation. This type of measurement provides data which plot against time as smooth curves of uniform and simple shape. The dynamic changes in dough can be measured with considerable precision and summarized in terms of two parameters. Painstaking studies have been made of the time-dependent effects on dough properties of bromate, iodate, oxygen, acidity, temperature, chelating agents and proteases. The data provide a basis for developing hypotheses as to the types of reactions that must occur at the molecular level to account for observed changes in the gross properties of the dough. "All facts fit the general hypothesis that the key structure in dough is a dynamic, three-dimensional polymer network. That the properties of the network, and thus of the dough, are changed by the making and breaking of cross-links between main strands, or by breaking of main strands themselves; that working a dough causes physical entanglement of the network and that there is disentangling during resting, both processes being conditioned by the complexity of the network." The main chains are doubtless proteins, but lipids and carbohydrates may well have roles to play. Several types of linkage must be involved, but ex-

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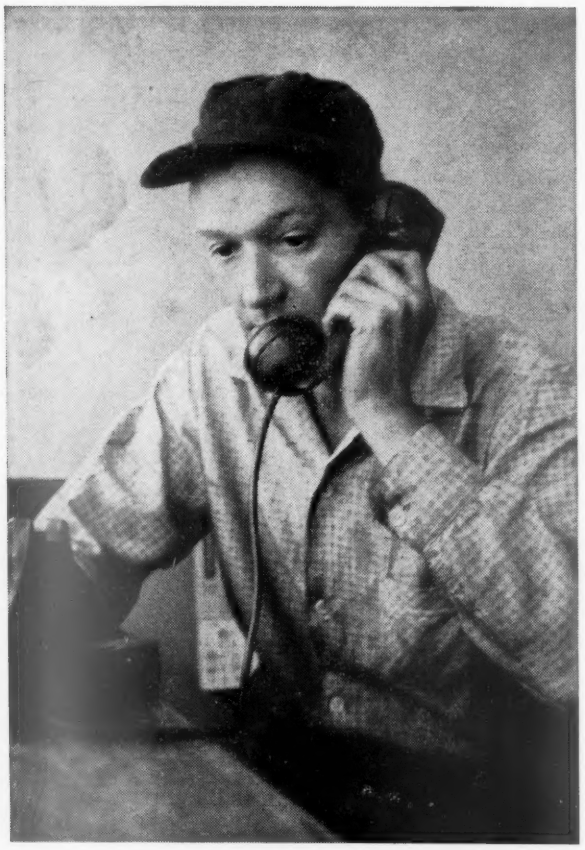

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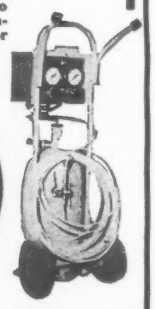

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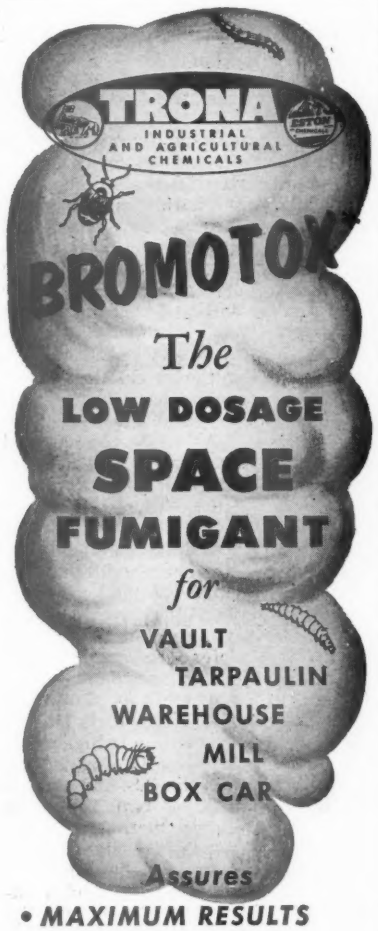
actly what groups are linked, and by what means, is not yet known.

The analytical attack relates to the generally held hypothesis that potassium bromate, and similar improvers, operate as oxidizing agents. Accordingly, it should be possible to relate rates of loss of bromate in dough to rates of changes of physical properties.

A first requirement was the development of a more precise quantitative method for bromate in dough—an example of the time and effort that must be devoted to development of tools required to follow a given line of investigation. Selection of the best samples for study is also difficult: patents, clears and the like; or different varieties or protein contents. "It is too easy to do too much work on a single sample, or too little on too many samples, or to study entirely the wrong set and to have to repeat the work with a different set. There are no rules, and little logic, applying to this phase of design of experiments."

Studies of rates of loss of bromate, iodate and other improvers, still in progress, indicate that several different reactions occur, and that lipid fractions are involved. Improver effects may not be associated with all reactions. The data are consistent with the hypothesis that improver effect is a function of oxidizing action, but provide little verification for the hypothesis. The sulfhydryl group and its possible implication in cross-linking of proteins has not been frogotten, but exploratory studies have consistently yielded negative results.

The line of attack developed most recently involves micro studies of the sorption of gases and vapors on flour and its components. Dough can be made with water but not with alcohol; why? Water causes gluten to cross-link, but this property is ex-



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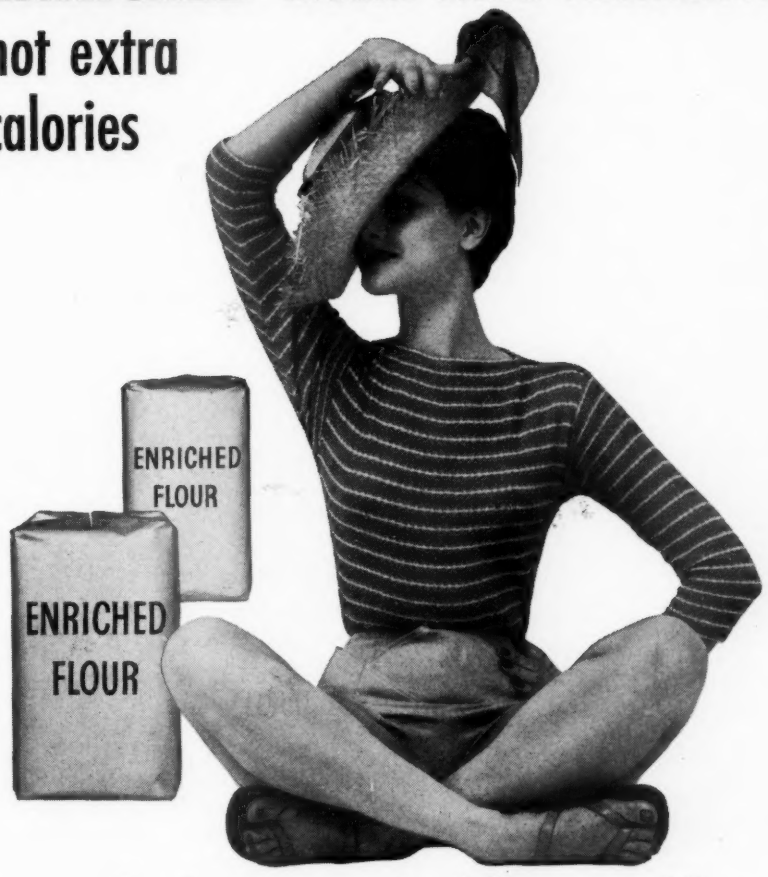

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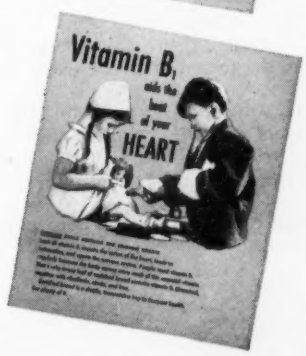

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hibited by only a few other reagents. Flour will form dough with liquid ammonia, hydrazine and liquid methylamine, but not with ethylamine or isopropylamine. On the basis of such studies "one can postulate about hydrogen bonding and the types of cross-links that may occur between certain groups in protein side-chains. But postulation is one thing and verification is another. Surely we shall need to know something about the formation of dough itself before we can fully elucidate the bromate effect.

Dr. Anderson emphasized that all these various researches relate to the main functions of the Grain Research Laboratory and have the same objective. The research seeks to improve the empirical test procedures used for assessing grain quality and to augment these by basic research relating to the nature of quality and better means of assessing it.

——BREAD IS THE STAFF OF LIFE——

FIRE DESTROYS PLANT

CHARLES TOWN, W. VA.—Fire destroyed the Peoples Supply Co., a grain and flour milling plant here, causing a loss estimated at $250,000 by Joseph Warrenfeltz, plant owner. A can of grease exploded to start the blaze in the two-story brick and stucco building.

Midwest Initiates Materials Handling Research Study

KANSAS CITY — The Midwest Feed Manufacturers Assn. this week awarded a contract to Richard Muther & Associates, Kansas City, for the research project on materials handling operations in feed mill warehouses.

This study will form the basis for a major report at the Midwest Feed Production School in Kansas City, Nov. 20-22.

The project is the second step and a follow-up to the research project on in-plant cost standards which was presented at the 1956 feed production school, and will be integrated with the prior study as far as possible. Data will be developed on (a) manpower utilization in the warehouse—particularly the nature and causes of delays; and (b) a set of standard time data which can be used to determine operating times for given methods of materials handling. The cost studies will be based on a standard mill of 100 tons per day capacity.

Members of the production school committee recommended to the Midwest executive committee that Richard Muther & Associates be selected to carry out the project. This firm was one of four which made proposals, including the Midwest Research Institute, Armour Research Foundation, and Bruce Payne Associates.

Committee members said the Muther firm has had special experience in materials handling investigations. Richard Muther, head of the organization, is a professional engineer and formerly was assistant professor of industrial management at Massachusetts Institute of Technology. He has taken part in numerous management conferences on industrial engineering problems, both in the U.S. and abroad. He is the author of two books on plant layout and production line technique and is a past president of the Pittsburgh chapter of the American Material Handling Society and a national director of the Society for the Advancement of Management.

The project will involve field studies of at least two selected mills in each of three categories of basic material handling systems—hand trucks, conveyors and lift trucks. Work sampling studies will be made in these mills to determine flow and character of materials. At the same time, actual motion and time studies will be made on selected materials to establish tables of standard time data of each type of operation. Use of warehouse space will be studied as related to volume and variety of feeds handled.

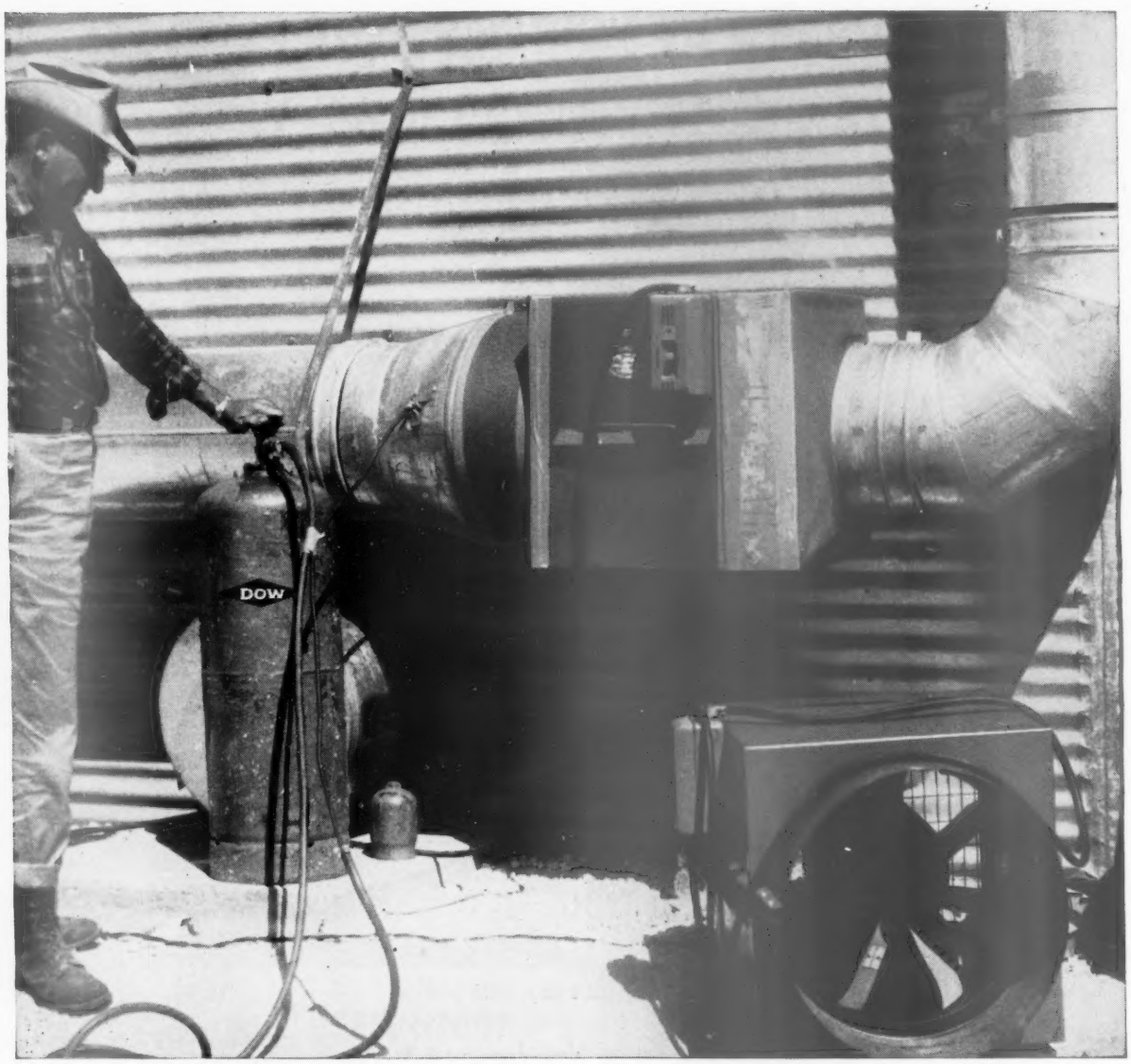
All of this material will be consolidated into a model warehouse operation showing likely areas for reducing waste, cost and delays. A standard will be developed in terms of man-hours per ton for the model mill.

The results of the report will be presented as part of the program of the 1957 Midwest Feed Production School and plans are being made to give visual demonstrations of the results, with actual equipment and handling procedures in the exhibition hall of the Kansas City Municipal Auditorium. Equipment used in the various warehousing operations involved will be in working display.

——BREAD IS THE STAFF OF LIFE——

DIVIDEND PAYABLE

NEW YORK—The board of directors of the American Molasses Co. declared a quarterly dividend of 17½¢ a share on common stock payable April 6, 1957 to shareholders of record at the close of business April 1, 1957.



Recirculation of Dow Methyl Bromide for

fumigation with measured safety and results

In fumigating bulk commodities, the natural advantages of Dow Methyl Bromide are used to best effect when applied by the forced air recirculation method.

This method of fumigating with methyl bromide makes an exact science of fumigation. It results in quick and uniform distribution of the fumigant in the grain mass, thereby assuring complete control of the insects.

You can save up to 50 percent in fumigant costs by recirculation because dosages are lower—fumigant distribution is better. Your present aerating system can probably be adapted to this improved fumigation process.

Fast-acting, Dow Methyl Bromide is also a superior fumigant for other uses such as vault, tarpaulin and box car, as well as building fumigation.

Write for further information on the recirculation process. Fumigant Sales Section, THE DOW CHEMICAL COMPANY, Midland, Michigan.

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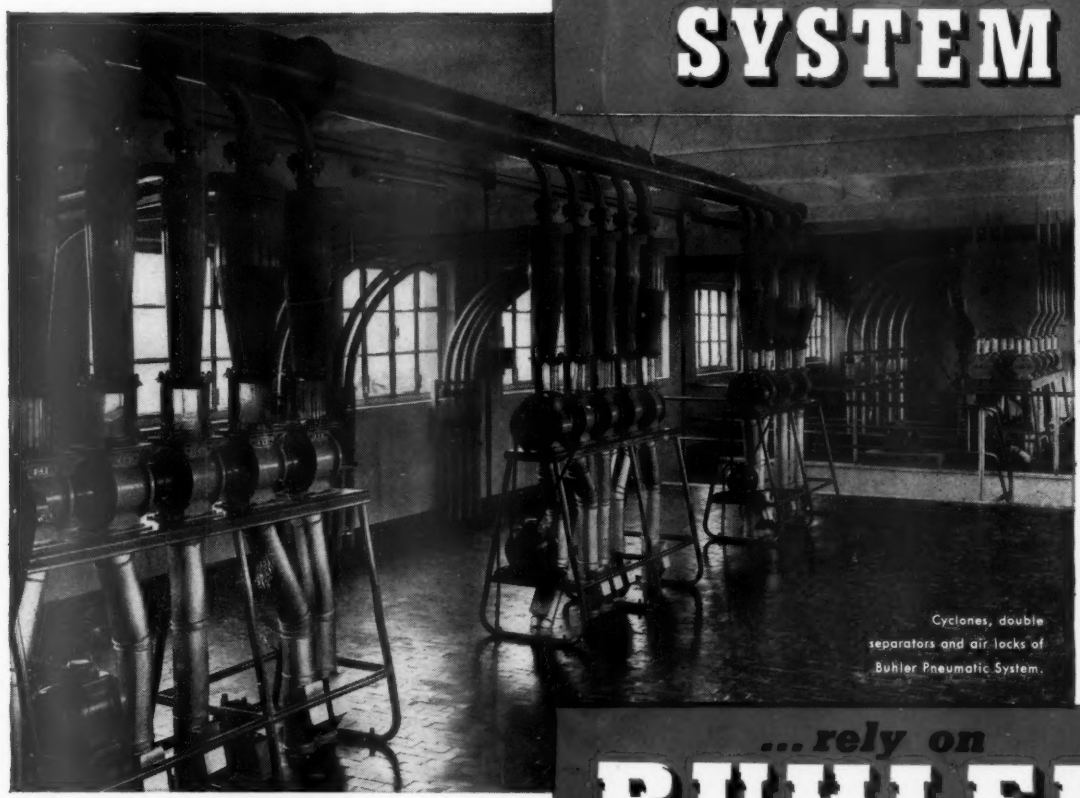

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CARTER DUO-ASPIRATOR

Your choice of OPEN CIRCUIT OR CLOSED CIRCUIT MODELS

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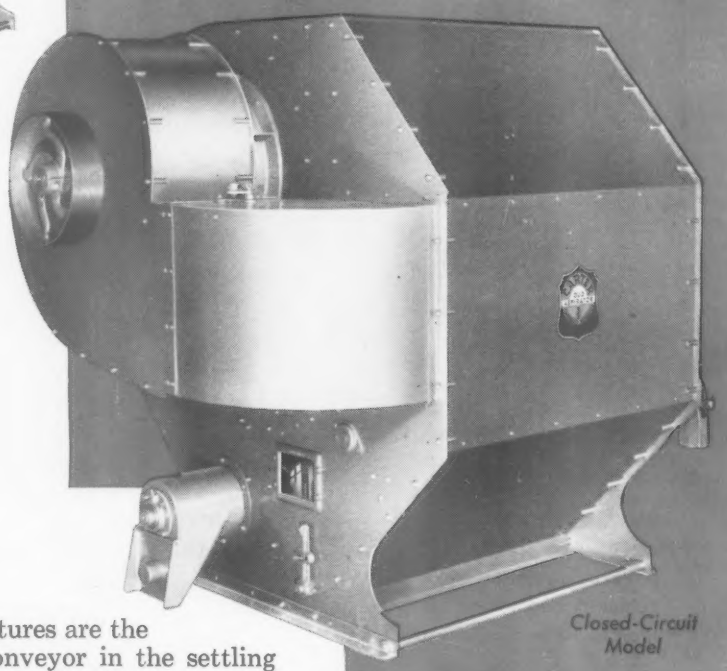
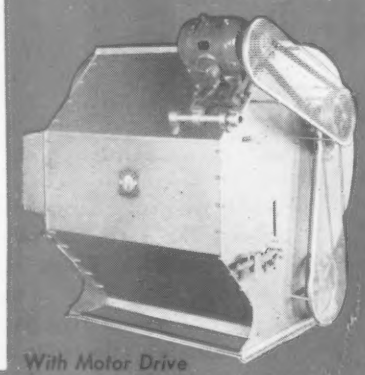


Closed-Circuit Model

The closed-circuit Duo-Aspirator provides two separations: the grain or heavier material is aspirated, and the lighter material removed. The open-circuit model provides three-way separation: the grain or other material is aspirated, the heavier material removed by aspiration is discharged from the settling chamber, and dust and other light material are exhausted from the fan to a collector.

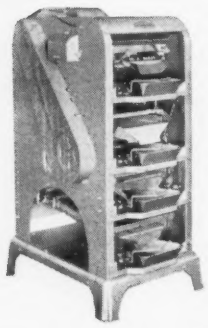
Outstanding among recently added features are the drop-bottom clean-out beneath the conveyor in the settling chamber, and a self-cleaning suction tube leading to the fan ... which combine to prevent any accumulation of material within the machine.

Other important features include: all-metal construction ... ball-bearings throughout ... compactness ... low power requirement.



With Motor Drive

Avoid unnecessary losses by testing your grain by official standards.



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